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Physics education students' perception on the use of motion detector in linear motion practicum

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Abstract. The use of technology in teaching and learning is very common today. In physics learning, practicum has an important role, namely deepening the understanding of concepts and applying concepts. However, it is interesting to know the importance of using technology in practicum. This study aims to know the student's Physics education students' perception on the use of motion detector in linear motion practicum. The present study was descriptive research using a qualitative approach. This research was carried out in mechanics experiment class with 16 students as research subjects. This study used students' reflection and interview in collecting perception's of the students. The research found that practicum with motion detector has significant role in results obtained. On the other hand, practicum with motion detector has insignificant role in the student's carefullness.

Keywords: Design research, perception, technology, practicum

1. Introduction

The use of technology in teaching and learning is very prevalent today. As teacher or lecturer now we have to integrate the use of technology in our class. For example. mobile phones that were once prohibited from being taken to class, now become essential part of some learning activities. Study about the relationship between cellphone use, academic performance, anxiety, and satisfaction in college student has been conducted by Lepp et. al [1] said that cell phone use was negatively related to academic performance. In addition, another work studies about relationship among smartphone addiction, stress, academic performance, and satisfaction with life has result that a smartphone addiction risk was negatively related to academic performance [2].

Physics is famous for its many equations, formulas, principles, and physical laws that student should memorize. In fact, the nature of physics rather than on memorizing but understanding [3]. This fact is what underlies the development of physics learning methods. Learning method that has purpose to deepen the understanding of certain concept is practicum. Practicum is categorized as one type of cooperative learning if done in pairs or groups and inquiry approach. Some studies indicate that practicum improving the student's science process skill [4-6].

Practicum or experiment in physics nowadays is done by using the help of technology or computer based. Practicum in laboratory is defined by Ref. [7] to be all work in Laboratory which include demonstration and simulation using computer. Practicum or lab work also is believed to be important in order for student obtain a conceptual understanding of the certain topics. Ref [8] study about using



smartphone in order to measure the gravitational acceleration in physics classroom. Castro-Palacio et.al [9] also study about using mobile phone acceleration sensor in physics experiment on free and damped harmonic oscillations.

Study about students perception about laboratory physics has been conducted by Ref. [10] found that using pre-lab exercises encourages a positive attitude and also gave positive responses such as 'fun', 'enjoyable', and 'interesting'. In line with Johnstone et. al's work, a survey conducted by Hanif et. al [11] showed that students believed that laboratory work provided them the chance to understand theory and problem solving skills. However, research that links between using sensor assisted laboratory work and traditionally is very few. So, we conducted a study that aim to know the student's Physics education students' perception on the use of motion detector in linear motion practicum.

2. Method

This study was descriptive research using a qualitative approach. This research was conducted at a private university in Yogyakarta. This research was carried out in Mechanics Experiment class with 16 students as research subjects. Mechanics Experiment course has learning objective to deepen the student's understanding in mechanics concept by doing practicum. For the mechanics concept, all students have taken Kinematics courses and are taking Dynamics course that are prerequisites for Mechanics Experiment course. Mechanics Experiment course consists of nine topics. We choose two topics about Linear Motion which are constant motion and acceleration motion to be studied about the students' perception on the use of motion detector.

The study was conducted in two meeting and the students did the practicum in pair. On the first meeting, students did linear motion - constant motion practicum without motion detector. On the second meeting, students did linear motion - acceleration motion with motion detector. After each meeting, students made a reflection regarding the practicum on the moodle based Learning Management System (LMS). The last step was conducted by interviewing three students on their general opinion about the practicum activity with and without motion detector. Three students were purposively chosen based on the student achievement. We obtain data by collecting the student's reflection and interview results. Then we analyze them with qualitative approach by using Atlas.ti software.

3. Results and Discussion

This study has aim to know the student's Physics education students' perception on the use of motion detector in linear motion practicum. Two meetings were conducted. First meeting, students studied linear motion - constant motion practicum without sensor. They use ticker timer in analyzing the motion. The second meeting students studied linear motion - acceleration motion using motion detector. We collected data by using the students' reflection after each meeting and interviewing three students purposively. We will elaborate the findings in each meeting on the following subsection:

3.1 First meeting - Ticker timer

Students did linear motion - constant motion using ticker timer. This practicum has learning goals: (a) to measure the speed of train (object), and (b) to obtain the equation of motion. The train is pushed and the motion of the train is recorded on a paper that connected to a ticker timer. Then the dots that pictured on the paper is measured and tabularized in Excel. Then they obtain the speed of train from the gradient of the graph position vs time.

From the reflection and interview, we found that mostly students state that the concept of linear motion is enhanced. Regarding this theme, students stated that by doing practicum provide a deeper understanding of the concept of motion of regular objects in addition to the presentation of theoretical concepts, so that they can also compare the results of the theory with the results of experiments. Second, when they did practicum, they have to repeat the procedure several times because the data did not meet the theory. From that, they learned about practicum requirement to obtain good data. Below are two quotations from students regarding enhancing concept:

“this practicum provide a deeper understanding of the concept of linear motion...”

“In my positive experience, I was able to further explore about linear motion practice because I repeated many times..”

Practicum tools also become the major theme from student's reflection and interview. They had difficulties in obtaining good data due to the practicum tools. The practicum tools are old, so it was less accurate. In addition, there were many papers waste. Especially if they repeated the practicum in many times. Below are the quotations from students:

“...sometimes the ticker timer that is used does not work properly maybe because it has been eaten by age.”

“...the negative is removing a lot of recording papers and in my opinion the board is not long enough.”

The third theme is applying and sharing. Students want to learn more about linear motion concept and then share to their students in the future.

“If the material is available at the place where I teach, I will apply what I get to my students later”

“What I will do in the future is that I will continue to learn it so that later I can share it with other children and I can apply it in daily life.”

3.2 Second meeting – motion detector

On the second meeting, students did linear motion – acceleration motion using motion detector. This practicum has learning goals: (a) to measure the speed of train (object), and (b) to measure the acceleration of train (object). The train is placed on a board. The board's slope is varied so that the train will experience different acceleration. Motion detector is placed behind the train and record the motion of train. The motion detector is connected to Laptop and the data is analyzed using Logger Pro software. The velocity and acceleration of the train is obtain by fitting the data in Logger Pro.

The main theme of students' statement for the motion detector is that the concept of linear motion is enhanced. First, student stated that the concept is more understandable by practicum than theory class. Second, by doing practicum student can relate between experimental and theory of linear motion. Below are two quotations from students regarding this theme

“The learning material is easier to understand through practice than explained.”

“in this experiment I was easier to relate the relationship between experimental results and theory.”

The second theme that is stated by students is result obtained. Students state that using sensor the data obtain is accurate. Moreover, the work is finish faster than using ticker timer because the analysis is done using Logger Pro software. Here two quotations from students regarding this theme:

“I feel excited because at this practicum I use the application so that it looks more real, and I think everything becomes easier with technology”

“The use of the logger pro application is also very helpful in the accuracy of the data because when conducting experiments the movement of the train is directly recorded on the laptop”

The other theme that is not stated in the without sensor is satisfied quickly. One student said that, he did not understand about the data processing from motion detector to Logger Pro. In addition, the other student said that by using motion detector will make students lazy to work using conventional way.

“...the negative side, students will lazy to work using conventional way”

“...while the negative side is that I do not understand even not yet fully understood about the calculation of the details because with the logger pro application the laptop directly inputs and the value appears without any detailed calculation process”.

3.3. Discussion

As the results, in table 1 we grouped the students' perceptions in four categories using Atlas.ti software.

Table 1. Categories of students' perceptions

Category	Code	without sensor (frequency)	with sensor (frequency)
Positive attitude	deep understanding	9	7
	effort	8	7
	enthusiastic	4	3
	result obtained	1	5
	applying and sharing	5	4
	critical thinking	2	2
	carefulness	4	0
Negative attitude	blaming practicum tools	4	4
	satisfied quickly	0	2

This study result is inline with Ref. [11] that laboratory works make student knowledge more deepen. The present study shows that this category applies whether the practicum is done with motion detector or not. There are three categories whose frequency is different that are result obtained, carefulness and satisfied quickly. As for result obtained category has been explained above. There are no student stated about carefulness in practicum with sensor. It is because student believe what sensor and Logger Pro obtained. They tend not to repeat the data collection. This fact is in line with satisfied quickly category that has been also explained above.

Instructor or teacher should elaborate more about laboratory work. In general, using motion detector or without sensor have the same results in order to deepen the students' understanding concept or material. However, instructor or teacher should make a lab activities that compatible with the learning objectives.

4. Conclusions

This study is want to know the student's Physics education students' perception on the use of motion detector in linear motion practicum. Data collection and data analysis has been explained in this paper. In addition, student's positive and negative attitude has been collected and identified as well. We found that practicum or laboratory work make the student knowledge about a concept more deepen. The present study found that practicum with motion detector has significant role in results obtained. On the other hand, practicum with motion detector has insignificant role in the student's carefulness. We suggest in the future research to measure the significancy of the science process skill of practicum with motion detector.

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